

REMARKS

Claims 1-16 are currently pending, wherein claims 6 and 14-16 have been amended to correct typographical errors. Applicants respectfully request favorable reconsideration in view of the remarks presented herein below.

At the outset, Applicants note with appreciation the indication that claims 14-16 contain allowable subject matter.

In paragraph 1, the Office Action objects to the specification because of various typographical errors. The specification has been amended to correct the errors, thereby addressing the Examiner's concerns.

In paragraph 2, the Office Action objects to claims 6 and 14-16 because of various typographical errors. Claims 6 and 14-16 have been amended to correct the errors, thereby addressing the Examiner's concerns.

In paragraph 4, the Office Action rejects claims 1, 2, 7, 9 and 11 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent Application Publication No. 2002/0057884 to *Hirose et al.* ("*Hirose*"). Applicants respectfully traverse this rejection.

Hirose discloses a heater module which improves the temperature uniformity in an optical waveguide. The heater module in accordance with *Hirose* comprises a heat-generating circuit adapted to generate heat when energized, and a heat-transmitting section disposed on an upper face of the heat-generating circuit and formed with a recessed groove portion for mounting the optical waveguide. (see page 2, paragraph 0013 of *Hirose*).

It is well known that in order to support a rejection under 35 U.S.C. §102, the applied reference must teach each and every claimed element. In the present case,

claims 1, 2, 7, 9 and 11 are not anticipated by *Hirose* for at least the reason that *Hirose* fails to disclose each and every claimed element as discussed below.

Independent claim 1 defines an optical fiber holding device. The device includes, *inter alia*, an optical fiber, a strip-shaped member, having a rectilinear groove in which the optical fiber is accommodated, a gel substance contacting with the optical fiber when placed in the groove of strip-shaped member, and a substrate on which the optical fiber and the strip-shaped member are mounted.

In rejecting claim 1, the Office Action asserts that the waveguide 12 of *Hirose* is equivalent to the claimed optical fiber, that the cover 35 is equivalent to the claimed strip-shaped member, and that the resin discussed in *Hirose* is equivalent to the claimed gel substance. These assertions are unfounded for the following reasons.

First, the optical waveguide 12 of *Hirose* is not equivalent to the claimed optical fiber. *Hirose* explicitly discloses that "it is *necessary* for an optical waveguide module 12 to draw thereinto an optical fiber 14"(emphasis added). Therefore, the waveguide 12 of *Hirose* cannot be interpreted a being equivalent to the claimed optical fiber for at least the reason that *Hirose* explicitly discloses that the guide is separate from the fiber.

Second, the cover 35 of *Hirose* is not equivalent to the claimed strip-shaped member for at least the reason that *Hirose* fails to disclose that the cover 35 includes a rectilinear groove as claimed in claim 1.

Finally, the resin 41 of *Hirose* is not equivalent to the claimed gel substance for at least the reason that *Hirose* fails to disclose that the resin contacts an optical

fiber when positioned in the groove of the strip-shaped member as claimed in claim 1 (i.e., resin 41 of *Hirose* contacts waveguide 12 not optical fiber 14).

Additional comments are as follows:

"In more detail, since an optical fiber has a diameter of 125 μm and principal ingredients which are quartz, it is likely to be susceptible to deformations due to applied stress. The optical waveguide of *Hirose* however has a very large cross section compared with an optical fiber. Therefore, the waveguide of *Hirose* only undergoes small deformations. Particularly, the invention as claimed in claim 1 is provided an optical fiber with a grating for compensating wavelength dispersion, thus arising a great interest in variations of PMD (polarization mode dispersion) due to stress. A detailed discussion on PMD is described below:

Fig. 1 in Attachment A is a view explaining the cause of the occurrence of PMD of the grating for compensating dispersion. There exists, in light propagating through an optical fiber, a TE component and a TM component which cross at right angles to each other. A phenomenon is generally referred to as PMD which has a different group delay time therebetween. Light of wavelength λ reflected on the grating is expressed by the following equation

$$\lambda = 2 \cdot N_{\text{eff}} \cdot \Lambda$$

Where N_{eff} denotes a grating (effective reflecting ratio of optical fiber), and Λ denotes a grating pitch. Fig. 1(a) is a model showing a grating for compensating dispersion. Fig. 1(b) is a cross section of a grating. Fig. 1(c) is a view showing the relationship between group delay characteristics and PMD. As shown in Fig. (a), a grating having a grating pitch in which is larger going from the left side to the right side shows group delay characteristics with respect to a wave which declines

constantly to the right as shown in Fig. 1(c). Here, a ratio of variations of the group delay time with respect to a wave is dispersion. The TE component and the TM component propagate diagonally within an optical fiber as shown in Fig. 1(b).

Accordingly, if the effective reflecting ratio in the vertical and lateral directions of the optical fiber are equal to each other, then the group delay characteristics would overlap at TE and Tm, respectively, or otherwise PMD will occur. For instance, let us now consider a case where a dispersion ratio is -400ps/nm and PMD is 4ps. In this case, a difference in a wave of TE and TM to be reflected at the same grating position is $4\text{ps}/(-400\text{ps/nm})=0.01\text{nm}$. See a portion A encircled by "o" in Fig. 1(c). Normally, the grating pitch Λ is in the order of 530nm and the reflection ratio N_{eff} is about 1.45. Thus, finding a reflecting ratio of TM with that of TE as 1.45 (on the assumption that TM is greater than TE) the following equations could be obtained:

$$2*N_{\text{eff}}^{\text{TM}}+530 = 2*N_{\text{eff}}(\text{TE})*530+0.01$$

$$N_{\text{eff}}(\text{TM}) = (2*1.45*530+0.01)/(2*530) = 1.450009433962$$

Namely, the equations imply that PMD of 4ps will occur with a difference of 0.000009433962 in the reflecting ratio of the cross section of the optical fiber in the vertical and lateral directions. Such a difference of the reflecting ratio of the cross section of the optical fiber in the vertical and lateral directions occur due to stress applied from outside. As an example, when compression stress is applied thereto in the vertical direction, density in the vertical direction becomes larger, which raises a reflecting ratio.

PMD having no grating is taught in *Hirose*.

PMD having no grating is equivalent to a difference in the group delay time of TE when light passes through the optical waveguide. Suppose that the length of the

optical waveguide is 10 cm, and the reflecting ratio of TE component is 1.45, then time (TE) taken to pass through the optical waveguide of 10 cm could be expressed by the following equations:

$$\text{Time(TE)} = 10\text{cm}/\text{light speed} = 0.1 \text{ (m)}/(\text{light speed in a vacuum}/\text{reflecting ratio})$$

$$= 0.1 \text{ (m)}/(3 \times 10^8 \text{ (m}\cdot\text{s)}/1.45) = 483.2\text{ps}$$

The reflecting ratio of TM component whose PMD is 4ps is obtained by the following equation as with the grating.

$$\text{Time (TM)} = \text{Time (TE)} + 4 \text{ (ps)}$$

$$487.3 \text{ (ps)} = 0.1\text{(m)}/3 \times 10^8 \text{(m/s)}/N_{\text{eff}}(\text{TM})$$

Thus

$$N_{\text{eff}}(\text{TM}) = 487.3 \times 10^{-12} / \{0.1\text{(m)}/(3 \times 10^8 \text{(m/s)})\} = 1.4619$$

The equations connote that PMD of 4ps will occur when there is a difference of 0.0119 in the reflecting ratio of the cross section of the optical fiber in the vertical and lateral directions.

As can be seen from the foregoing discussions, comparing PMD having a grating with that having no grating comes out that the former is far sensitive to the occurrence of PMD due to stress. Hence, close attention should be paid to prevent stress.

For the reasons stated above, limitations are set forth in the instant invention as claimed in claim 1 by providing a gel around the optical fiber, whereas a choice of resin such as grease, silicon resin, and epoxy resin are admitted in *Hirose*. Although in the invention an option of various resins such as silicon resin or epoxy resin have been examined thoroughly, distinctions over *Hirose* are evident from an obvious fact

that the invention chooses gel in view of the occurrence of PMD.” Applicants respectfully submit that there is a distinction between gel as claimed in claim 1 and resin as disclosed in *Hirose*.

Claims 2, 7, 9 and 11 each depend from independent claim 1. Therefore, claims 2, 7, 9 and 11 are patentably distinguishable over *Hirose* for at least those reasons presented above with respect to claim 1. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 1, 2, 7, 9 and 11 under 35 U.S.C. §102(e).

In paragraph 6, the Office Action rejects claims 3-5, 8, 10 and 12 under 35 U.S.C. 103(a) as allegedly being unpatentable over *Hirose* in view of the admitted prior art (“APA”). Applicants respectfully traverse this rejection.

It is well known that in order to support a rejection under 35 U.S.C. §103(a), the Office Action must make a *prima facie* case of obviousness. In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some motivation to combine or modify the applied references. Second there must be a reasonable expectation of success, and finally, the combination must teach each and every claimed element. In the present case, claims 3-5, 8, 10 and 12 are not properly rejected under 35 U.S.C. §103(a) because the Office Action fails to establish a *prima facie* case of obviousness. More specifically, the Office Action fails to meet two of the three basic criteria as discussed below.

In rejecting claims 3-5, 8, 10 and 12, the Office Action asserts that although *Hirose* fails to disclose an optical fiber having a grating, wherein the optical fiber is in contact with a heater, it would have been obvious to one skilled in the art modify the

system of *Hirose* to include an optical fiber having a grating as claimed in order to provide compensation for the wavelength dispersion of the optical signals propagated through the fiber and direct heat transfer between the heater and the optical fiber. However, the mere fact that a reference can be modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination (see MPEP §2143.01).

Therefore, the mere fact that the optical fibers with gratings are known in the art is not sufficient to establish a case of obviousness absent some evidence of the desirability of such a fiber in *Hirose*. *Hirose* explicitly teaches a heater 20 connected to a waveguide 12 via a resin or grease-like resin 41. *Hirose* also explicitly teaches that an optical fiber 14 is inserted in the waveguide 12. Accordingly, *Hirose* explicitly teaches away from the modification proposed by the Examiner. Therefore, the rejection of claims 3-5, 8, 10 and 12 under 35 U.S.C. §103(a) is improper.

Furthermore, even if the prior art optical fiber was inserted in the waveguide of *Hirose*, the modification would still fail to render claims 3-5, 8, 10 and 12 unpatentable because the combination fails to disclose each and every claimed element. More specifically, the combination of *Hirose* and the APA fails to disclose, a) a strip-shaped member having a rectilinear groove in which the optical fiber is accommodated, or b) the gel substance is in contact with the optical fiber as claimed in claim 3. Accordingly, claims 3-5, 8, 10 and 12 are patentably distinguishable over the combination of *Hirose* and APA for at least the reason that the combination fails to disclose each and every claimed element. Therefore, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 3-5, 8, 10 and 12 under 35 U.S.C. §103(a).

In paragraph 7, the Office Action rejects claims 6 and 13 under 35 U.S.C. §103(a) as allegedly being unpatentable over the combination of *Hirose* and APA, further in view of U.S. Patent No. 5,671,307 to *Lauzon et al.* ("*Lauzon*"). Applicants respectfully traverse this rejection.

Claim 6 defines an optical fiber holding device that includes, in addition to the features of claim 3 from which it depends, a Peltier element and a temperature sensor. Furthermore, independent claim 13 defines an optical dispersion-equalizer that includes, *inter alia*, an optical fiber having a grating, a strip-shaped member, having a rectilinear groove in which the optical fiber is accommodated, a gel substance in contact with the optical fiber, a Peltier element and a temperature sensor. Accordingly, claims 6 and 13 are patentably distinguishable over the combination of *Hirose* and APA for at least the reason that the combination fails to disclose an optical fiber, a gel substance in contact therewith, and strip-shaped member having a rectilinear groove as claimed (see discussed above with respect to claim 3).

Lauzon discloses a system that utilizes a temperature gradient to impose a chirp on a fiber Bragg grating. The system includes among other things a Peltier element and a temperature sensor, however *Lauzon* fails to overcome the deficiencies of *Hirose* and the APA.


Since *Hirose*, the APA and *Lauzon* each fail to disclose or suggest a) an optical fiber having a grating, b) a gel substance in contact with the optical fiber and c) a strip-shaped member having a rectilinear groove in which the optical fiber is accommodated as claimed, the combination of these three references cannot possibly disclose or suggest said elements. Therefore even if one skilled in the art

were motivated to combine *Hirose*, the APA and *Lauzon*, as suggested by the Office Action, the combination would still fail to render claims 6 and 13 unpatentable for at least the reason that the combination fails to teach each and every claimed element. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 6 and 13 under 35 U.S.C. §103(a).

The application is in condition for allowance. Notice of same is earnestly solicited. Should the Examiner have any questions regarding this application, he is invited to call the undersigned at the telephone number provided below.

Respectfully submitted,

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